EN_11: Fundamental Geometry of the Universe: ++++ Metric, Dual Universe, and Geometric Origin of G and $\hbar$

Résumé

Il développe la géométrie fondamentale de l'univers dans $\mathbb{C}^4$ avec des coordonnées complexes et une métrique $ds^2 = dx^2 + dy^2 + dz^2 + dt^2$ (++++). Cette structure induit un univers dual : partie réelle (espace observable) et partie imaginaire (temps vectoriel tridimensionnel). La projection sur le sous-espace réel génère naturellement la métrique de Minkowski (-+++), expliquant le signe négatif du temps sans le postuler. Il définit les rayons R_{VED} et R_{Sch} et démontre que leur produit $Y = R_{\mathrm{VED}} \cdot R_{\mathrm{Sch}} = 4n\hbar G/(\pi c^3)$ est indépendant de la masse. Il en déduit que G et $\hbar$ émergent de la même constante géométrique Y, et qu'ils sont inversement proportionnels. Il introduit le "paradoxe de la masse" comme un nouveau phénomène physique.

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1. Introduction

This work presents a complete geometric development that leads to two extraordinary results:

1. The fundamental constants of gravitational and quantum physics, the universal gravitational constant G and the reduced Planck constant $\hbar$, **are not independent entities**, but rather emerge from a **single geometric structure**.
2. Both constants **do not depend on mass**, although paradoxically **it is necessary to start from a specific mass** (proton, black hole, entire universe) to calculate their exact numerical value.

This result leads to a profound and completely new paradox in theoretical physics.

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2. Fundamental Metric and Complex Universe

Consider a four-dimensional universe defined over the field of complex numbers:

$$(X, Y, Z, T) \in \mathbb{C}^4$$

where each coordinate is expressed as:

$$\begin{aligned} x &= a_1 + b_1 i \\ y &= a_2 + b_2 j \\ z &= a_3 + b_3 k \\ t &= a_4 + b_4 l \end{aligned}$$

with $i^2 = j^2 = k^2 = l^2 = -1$.

The fundamental metric of the universe is:

$$ds^2 = dx^2 + dy^2 + dz^2 + dt^2 \quad (++++)$$

This metric **does not distinguish between space and time**: all dimensions are geometrically equivalent.

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3. Dual Universe: Real and Imaginary Parts

The complex structure induces a **natural duality**:

- The **real part** (a_1, a_2, a_3) defines the **observable physical space**.
- The **imaginary part** $(b_1 i, b_2 j, b_3 k, b_4 l)$ defines a **three-dimensional vector time**, not directly observable.

The physical universe we perceive is only a **real projection** of a broader universe, which possesses an imaginary part with physical properties.

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4. Projection to the Minkowski Metric

By projecting the ++++ metric onto the real-imaginary subspace, the Minkowski metric is naturally recovered:

$$ds^2 = -dt^2 + dx^2 + dy^2 + dz^2 \quad (-+++)$$

The negative sign of time arises **not as a postulate**, but as a consequence of the complex structure of the universe.

This provides a profound geometric interpretation of time: time is not an illusion, but the **structural synthesis** that generates space.

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5. Fundamental Geometric Radii

For any mass M, two fundamental radii are defined:

5.1 VED Radius (wave confinement)

$$R_{\mathrm{VED}} = \frac{2n\hbar}{\pi M c}$$

This radius describes the exact confinement of waves in 3S+T spacetime.

5.2 Schwarzschild Radius

$$R_{\mathrm{Sch}} = \frac{2GM}{c^2}$$

This radius describes the gravitational geometry associated with the mass.

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6. Constant Product of Radii

Define the geometric product:

$$Y = R_{\mathrm{VED}} \cdot R_{\mathrm{Sch}}$$

Substituting the above expressions:

$$Y = \left(\frac{2n\hbar}{\pi M c}\right)\left(\frac{2GM}{c^2}\right) = \frac{4n\hbar G}{\pi c^3}$$

Fundamental Result

- **The mass M cancels exactly**
- The product Y **does not depend on mass**

This fact is strictly mathematical and not approximate.

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7. Geometric Expression of G and ħ

From the definition of Y we obtain:

$$G = \frac{\pi c^3}{4n\hbar} Y$$

$$\hbar = \frac{\pi c^3}{4nG} Y$$

This demonstrates that:

- G and $\hbar$ **emerge from the same geometric constant** Y
- Neither is fundamental on its own

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8. Inverse Relationship Between G and ħ

The product of both constants is:

$$G \cdot \hbar = \frac{\pi c^3}{4n} Y$$

Therefore:

- G is **geometrically inverse** to $\hbar$
- Knowing one, the other is completely determined

This is not a dimensional coincidence, but a direct consequence of the geometry of the universe.

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9. The Paradox of Mass

Here appears a deeply surprising result:

- G and $\hbar$ **do not depend on mass**
- However, **to calculate their exact numerical value it is necessary to start from a specific mass**

This implies:

- Mass **does not define** the constants
- Mass acts as a **necessary geometric reference** to access their value

This phenomenon has no precedent in known physics.

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10. Physical Interpretation

1. The universe is geometrically **real–imaginary**
2. Time is a **three-dimensional complex vector**
3. Space emerges as a **differential of time**
4. Fundamental constants are **geometric properties**
5. Mass is a **measurement instrument**, not an origin

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11. Conclusion

This development shows that:

- The ++++ metric is more fundamental than the Minkowski metric
- Time is not an illusion, but the structural key of the universe
- G and $\hbar$ originate from a single geometric constant

- The mass paradox reveals a new layer of physical reality

We are faced with a surprising, coherent, and deeply revealing structure, which opens a completely new path for understanding fundamental physics.

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12. Future Work

- Complete English development
- Numerical implementation in Python
- Extension to cosmology and the complete universe
- Study of the topology underlying the geometric constant Y

End of EN_11

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